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OPTICAL SYSTEM

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[Abstract]

The invention pertains to an optical system and can be used in high performance optical imaging systems in the wavelength region from 150 to ≤ 10,000 nm. The task of creating an optical system in which the secondary spectrum has been corrected over a large spectrum, according to the application purpose, with the same or a reduced number of lenses by comparison to optical glass, remedying the disadvantages of the known prior art, serves as the objective of the invention. This task is accomplished by means of an optical system in which BaF_2 is used as a single crystal optical medium, and the selection of the types of glass for its partner components can follow as a result of this. Figure

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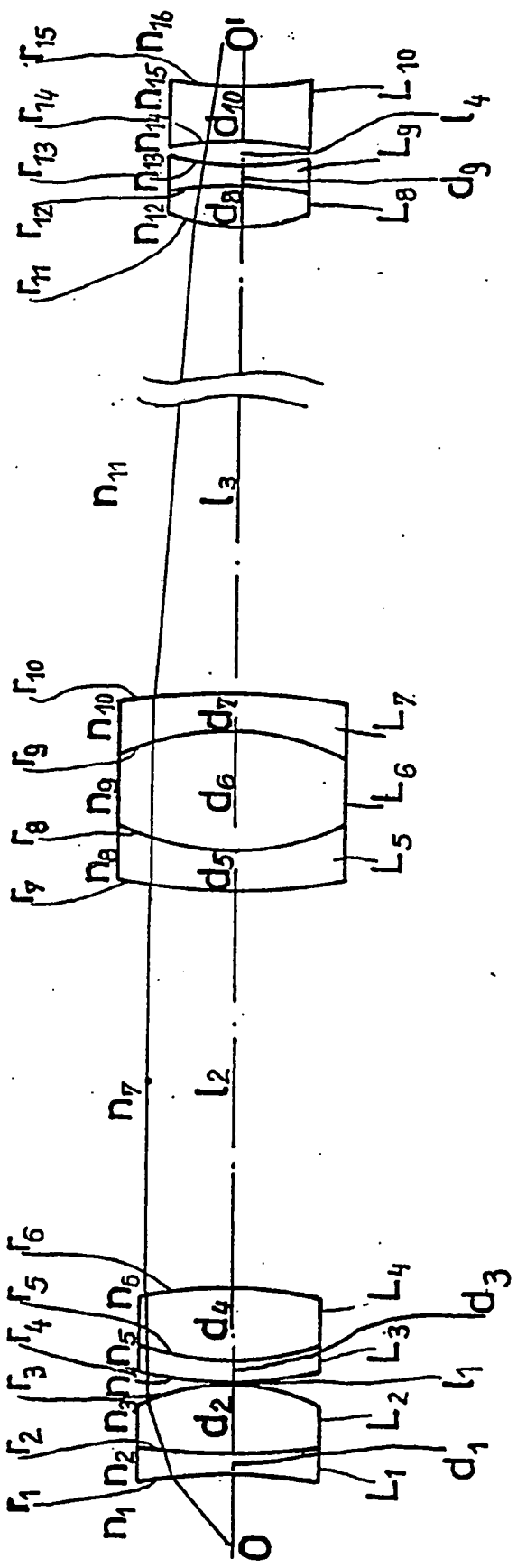
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Claims

1. Optical system in which optical types of glass and single crystals are used as optical media, characterized by the fact that BaF_2 is used as a single crystal medium and that, in combination with other optical media, the secondary spectrum can be corrected as far as into the low UV.

2. Optical system according to Claim 1, characterized by the fact that correction of the secondary spectrum extends over a wavelength range from 150 to 2,000 nm depending on the application purpose.

3. Optical system according to Claims 1 and 2, characterized by the fact that an assembled construction is characterized by the values indicated in Table 1.

1 page of drawings attached

Invention application field

The invention can be used in high performance imaging systems in the wavelength range from 150 to $\leq$ 10,000 nm.

Prior art

Known technical solutions for high performance optical imaging systems are based on the use of optical glass and individually selected single crystals such as, for example, fluorspar, alum and KRS 5. The use of optical glass is limited by its restriction to transmission in the wavelength range from approximately 380 to 1,500 nm and by small deviations of the relative partial dispersion from the normal lines, as a result of which correction of the secondary spectrum is limited.

The single crystals that are usually used have transmissions which permit modeling of optical systems in extreme spectral regions (UV, IR) as well. The deviation from the normal lines of the relative partial dispersion is generally higher than in the case of optical types of glass. The difficulty lies in finding types of glass for the partner components that permit sufficient correction of the secondary spectrum and other image deficiencies.

Consequently, a large number of lenses is required in optical systems. Problems in the machining technology of the crystals arise as well.

Objective of the invention

The objective of the invention is an optical system that remedies the disadvantages of the known prior art.

Disclosure of the essential features of the invention

The task that forms the basis of the invention is creation of an optical system with the same or a reduced number of lenses by comparison to optical glass, wherein the secondary spectrum has been corrected over a large spectral region according to the application purpose.

This task is accomplished according to the invention by an optical system using barium fluoride BaF_2 as the single crystal medium.

The secondary spectrum can be additionally corrected as far as into the low UV with the same or a reduced number of lenses, by comparison to optical glass, as a result of the use of BaF_2 in combination with various types of optical glass. In terms of optical properties, it is simpler in this case to find types of glass for the partner components and to use a processing technology that is comparable to that used for fluorspar. According to the invention, correction of the secondary spectrum extends over a wavelength range from 150 to 2,000 nm depending on the purpose application. Characteristic values of a solution according to the invention are indicated in Table 1.

Embodiment example

The essential features of the invention will be elucidated in more detail by means of a 0.3/20 fine measurement objective that is illustrated in the drawing, with its schematic assembly being shown in Figure 1.

Lenses L 1... L 10 are arranged along the optical axis 0-0' in four cemented groups and as an individual biconcave lens. The individual lenses are characterized by their central thicknesses d_i, their radii r_i and their refractive indices n_i, whereas the air separations that are required are designated I_i. A planapochromat for the wavelength range from 480 to 800 nm can be calculated as a result of the use of BaF_2 as the optical medium for the lenses L 4 and L 6, whereby the secondary spectrum is virtually zero over the whole range.

A previously known solution was a planachromat with the same number of lenses and magnification that was corrected in the wavelength range from 480 to 643.87 nm; the secondary spectrum amounted to 2.8 λ/A^2.

Table 1

S' = 144.62 with 39 nm BK 7 and 56 mm BaK 4 glass pathway

S = −13,691

$E_p = \infty$ Radius		① Brechzahl n_e		② Abstand	
r_1	= −43,5	n_1	= 1		
r_2	= +56,2	n_2	= 1,531870	d_1	= 2,0
r_3	= −16,4	n_3	= 1,55440	d_2	= 6,0
r_4	= +55,7	n_4	= 1	l_1	= 0,1
r_5	= +23,9	n_5	= 1,694160	d_3	= 2,0
r_6	= −33,5	n_6	= 1,47586	d_4	= 6,0
r_7	= +48,0	n_7	= 1	l_2	= 38,4
r_8	= +21,0	n_8	= 1,531870	d_5	= 3,5
r_9	= −21,0	n_9	= 1,47586	d_6	= 10,0
r_{10}	= −104,6	n_{10}	= 1,531870	d_7	= 3,5
r_{11}	= +15,1	n_{11}	= 1	l_3	= 93,6
r_{12}	= −51,7	n_{12}	= 1,727940	d_8	= 3,73
r_{13}	= +20,4	n_{13}	= 1,531870	d_9	= 1,4
r_{14}	= −30,8	n_{14}	= 1	l_4	= 2,0
r_{15}	= +28,8	n_{15}	= 1,734438	d_{10}	= 1,86
		n_{16}	= 1		

Key: 1 Refractive index n_e
2 Separation